

# Information Booklet

Institute of Information and Communication Technology (IICT)

**Bangladesh University of Engineering and Technology  
BUET, Dhaka-1000, Bangladesh**

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## Preface

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The Institute of Information and Communication Technology (IICT) was established by the Syndicate of BUET in its 362nd meeting held in June, 2001 by converting the erstwhile Computer Centre. The purpose of the Institute is to provide a platform for teaching, learning and research in information and communication technology (ICT) that will contribute to industrial and infrastructural development, economic growth and social prosperity. One of its main aims and objectives include offering courses leading to diplomas and degrees in the field of ICT and to initiate, organize and perform studies and research on practical applications of ICT.

In the present world the importance of promoting and providing facilities for development of skilled manpower in ICT can never be overstated. This branch of education plays a vital role in modernizing and improving the quality of lives of the people on earth.

This booklet provides general information about this university, its historical background, faculties and teaching departments, university administration etc. Main emphasis of this booklet is to provide the detailed syllabus for the postgraduate courses this institute offers, namely Post-graduate Diploma in Information and Communication Technology and Master's in Information and Communication Technology.

It is hoped that this booklet will be of much use to the students as well as anybody interested in the activities of IICT.

Dhaka, Bangladesh  
May, 2008

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Director, IICT  
Email: [lutfulkabar@iict.buet.ac.bd](mailto:lutfulkabar@iict.buet.ac.bd)



# CHAPTER 1

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## General Information

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### 1.1 The University

Bangladesh University of Engineering and Technology (BUET), is the oldest institution for study of Engineering and Architecture in Bangladesh. Today's BUET originated as Survey School at Nalgola in 1876 to train Surveyors for the then Government of Bengal of British India. As the years passed, the Survey School became the Ahsanullah School of Engineering offering three-year diploma courses in Civil, Electrical and Technical Engineering. In 1948, the School was upgraded to Ahsanullah Engineering College (at its present premise) as a Faculty of Engineering under the University of Dhaka, offering four-year bachelor's degrees in Civil, Electrical, Mechanical, Chemical and Metallurgical Engineering. This action was taken with a view to meet the increasing demand for engineers in the newly independent country and to expand the facilities for quicker advancement of engineering education, in general. In order to create facilities for postgraduate studies and research, in particular, Ahsanullah Engineering College was upgraded to the status of a University giving a new name of East Pakistan University of Engineering and Technology in year 1962. After the birth of Bangladesh in 1971, it was renamed as the Bangladesh University of Engineering and Technology.

Till today, it has produced around 20,000 graduates in different branches of engineering and has established a good reputation all over the world for the quality of its graduates, many of whom have excelled in their profession in different parts of the globe. It was able to attract students from countries like India, Nepal, Iran, Jordan, Malaysia, Sri Lanka, Pakistan and Palestine.

BUET campus is now in the heart of the city of Dhaka. It has a compact campus with halls of residence within walking distances from the academic buildings.

### 1.2 Faculties, Departments and Degrees Offered

The University has sixteen teaching departments under five faculties. Not all of them are degree offering. Undergraduate courses in the Faculties of Engineering, Civil Engineering, Electrical

& Electronic Engineering and Mechanical Engineering extend over four years and lead to B.Sc. Engineering degrees in Civil, Electrical & Electronics, Mechanical, Chemical, Computer Science & Engg., Materials and Metallurgical Engineering and Naval Architecture & Marine Engineering. In the Faculty of Architecture and Planning, the degree of Bachelor of Architecture is obtained in five years and the degree of Bachelor of Urban & Regional Planning in four years.

Postgraduate studies and research are now among the primary functions of the university. Most of the departments under the different faculties offer M. Sc. Engg. & M.Engg., M. Phil degrees and some departments have started Ph.D. courses. Postgraduate degrees in Architecture (M.Arch.) and in Urban and Regional Planning (MURP) are offered by the Faculty of Architecture and Planning. In addition to its own research programs, the university undertakes research programs sponsored by external organizations, viz., UN Organizations, Commonwealth, Bangladesh University Grants Commission (BUGC), Ministry of Science, Information & Communication Technology (GOB), etc. The expertise of the university teachers and the laboratory facilities of the university are also utilized to solve problems and to provide current engineering and technological knowledge to various organizations of the country. Faculty-wise list of the departments with the status of the degrees offered are given below:

<b>Faculty</b>	<b>Departments</b>	<b>Degree Offering</b>
Architecture & Planning	Dept. of Architecture Dept. of Urban and Regional Planning Dept. of Humanities	PG and UG PG and UG
Civil Engineering	Dept. of Civil Engg. Dept. of Water Resources Engg.	PG and UG PG and UG
Electrical & Electronic Engg.	Dept. of Electrical and Electronic Engg. Dept. of Computer Science & Engg.	PG and UG PG and UG
Engineering	Dept. of Chemical Engg. Dept. Materials & Metallurgical Engg. Dept. of Chemistry Dept. of Mathematics Dept. of Physics Dept. of Petroleum & Mineral Resources Engg.	PG and UG PG and UG PG PG PG PG
Mechanical Engineering	Dept. of Mechanical Engg. Dept. of Industrial & Production Engg. Dept. of Naval Architecture & Marine Engg.	PG and UG PG and UG PG and UG
Institute of Information and Communication Technology		PG
Institute of Water and Flood Management		PG

### 1.3 The Central Library

The four storied library building which has a floor space of 19,775 sft stands close to the academic buildings. It is a compact library which built in facilities to provide various services to students, teachers and researchers and to perform administrative and technical job. The university library is primarily a reference and research library for use of staff and students of the students of the university and visiting scholars.

## **1.4 University Institutes, Centers, Directorates and Link Programs**

### **Institutes and Centers:**

1. Institute of Water and Flood Management (IWFM)
2. Institute of Appropriate Technology (IAT)
3. Institute of Information & Communication Technology (IICT)
4. International Training Network Centre (ITN)
5. Center for Energy Studies (CES)
6. Center for Environmental & Resource Management (CERM)
7. Center for Biomedical Engineering Research (CBER)
8. Accident Research Institute (ARI)

### **Directorates**

1. Directorate of Advisory, Extension & Research Services (DAERS)
2. Directorate of Planning and Development (P&D)
3. Directorate of Students' Welfare (DSW)
4. Directorate of Continuing Education (DCE)

### **Bureau of Research, Testing & Consultation (BRTC)**

### **Linkage Projects:**

1. University of Alberta-BUET Institutional Linkage Project
2. BUET-DUT Linkage Project
3. BUET-University of Exeter (UK) Link Program
4. BUET-University of Loughborough (UK) Link Program
5. BUET-University of Leuven Link Program
6. BUET-University of Birmingham Link Program
7. Bangladesh International Training Network Center for Water Supply & Waste Management-ITN

## 1.5 University Administration

### The Chancellor of the University

Dr. Fakhruddin Ahmed

Chief Adviser to the Caretaker Government of the Peoples Republic of Bangladesh

### The Vice Chancellor

Prof. Dr. A. M. M. Safiullah

### The University Syndicate

*Chairman:* Vice Chancellor, BUET

*Members:*

Dean, Faculty of Civil Engineering, BUET

Dean, Faculty of Architecture and Planning, BUET

Director General, Secondary and Higher Education, Govt. of Bangladesh

Director General, Technical Education, Govt. of Bangladesh

Prof. Dr. Wakil Ahmed, Road No.-11/A, House No.-86, Dhanmondi, Dhaka-1209

Prof. Dr. Md. Serajul Islam, Dean Faculty of Business Studies, University of Dhaka

Prof. Dr. Md. Sultan Hossain, House No.-33, Road No.-11, Sector No.-6, Uttara, Dhaka-1230

Prof. Dr. M. Abu. Taher Ali, Department of Mechanical Engineering, BUET

Prof. Dr. Ehsanul Haque, Member, Bangladesh University Grants Commission (UGC)

Prof. Md. Khairul Enam, Department of Architecture, BUET

### Deans of Faculties

Dean of Civil Engineering

Prof. Dr. Md. Abdur Rouf

Dean of Architecture and Planning

Prof. Dr. Sarwar Jahan

Dean of Electrical and Electronic Engineering

Prof. Dr. S. Shahnawaz Ahmed

Dean of Mechanical Engineering

Prof. Dr. Md. Abdur Rashid Sarker

Dean of Engineering

Dr. A A Md. Rezaul Haque

### University Administration

Director of Students' Welfare

Professor Dr. Maglub Al Nur

Director, Bureau of Research, Testing & Consultation

Professor Dr. A. M. M. Taufiqul Anwar

Director of Planning & Development

Professor Dr. Sk. Sekender Ali

Director of Advisory, Extension & Research Services

Professor Dr. Md. Quamrul Islam

Registrar

Md. Shahjahan

Controller of Examinations

Professor Dr. Abu Siddique

Comptroller

Md. Jashim Uddin Akanda

Librarian

Mohammad Zahirul Islam

Superintending Engineer

M.M. Abdul Alim

**Directors of Institutes & Centers**

Institute of Water and Flood Management	Professor Prof. Dr. Md. Anisul Haque
Institute of Appropriate Technology	Prof. Dr. Md. Kamal Uddin
Institute of Information & Communication Technology	Professor Dr. S.M. Lutful Kabir
Accident Research Institute (ARI)	Professor Dr. Md. Mazharul Hoque
Centre for Energy Studies	Professor Dr. Shahidul Islam Khan
Centre of Continuing Education	Professor Dr. Md. Abdur Rashid Sarker
Centre for Biomedical Engineering Research	Professor Dr. Md. Aynal Haque

**Provosts of Residential Halls**

Ahsanullah Hall	Professor Dr. Khan Mahamud Amanat
Chattri Hall	Dr. Md. Abdul Matin
Shahid Smriti Hall	Professor Dr. Sarwar Jahan Md. Yasin
Sher-e-Bangla Hall	Professor Dr. Khondoker Mohammed
M.A. Rashid Hall	Professor Dr. Q. Deen Mohd. Khosru
Suhrawardy Hall	Dr. Eqramul Hoque
Nazrul Islam Hall	Professor Dr. Md. Ehsan
Titumir Hall	Professor Dr. Md. Zahrul Haq

## 1.6 University Address

**Mailing Address:** Bangladesh University of Engineering & Technology (BUET)  
Dhaka-1000  
Bangladesh

**Telephone Numbers:**

PABX: 880-2-966 5650-80 ; 880-2-861 6833-38;  
880-2-861 4640-44 ; 880-2-861 8344-49  
FAX No: 880-2-861 3046 ; 880-2-861 3026

**Website:**

<http://www.buet.ac.bd/>



## CHAPTER 2

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### Institute of Information and Communication Technology (IICT)

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The Institute of Information and Communication Technology (IICT) is the youngest institute of Bangladesh University of Engineering and Technology. The Syndicate of BUET had taken the decision on 28th June, 2001 to start the institute and the formal inaugural ceremony of the institute was held on 2nd September, 2001. The syndicate had taken the decision following a decision of the government in order to produce more professionals in IT sector. The erstwhile Computer Center of BUET has been taken as the backbone of the institute and the previous center has been modified accordingly to form the institute. The main objectives of the institute include offering Post Graduate programs in addition to the services as were provided by the erstwhile Computer Center.

The institute is located on 14,000 sq. ft. of space on the fourth and fifth floor of the Civil Engineering Building, BUET. Located within the serene environment of BUET, IICT is an ideal place for technology based education. It is easily accessible by major roads from all parts of the city. Its proximity to residential areas, markets, universities, industries and research centers makes it an excellent spot for its members to avail all their necessities.

#### **2.1 Aims and Objectives of IICT**

The purpose of the Institute is to provide a platform for teaching, learning and research in information and communication technology (ICT) that will contribute to industrial and infra-structural development, economic growth and prosperity. The aims and objectives of the IICT are:

- To actively pursue advanced research in ICT in order to develop knowledge based products and services;
- To develop ICT facilities in order to create an on-campus environment conducive to enthusiasm, innovation and enterprise, and to nurture innovative ideas and incubate promising initiatives;

- To produce manpower and expertise in ICT by carrying out training in diverse areas for those interested to step in ICT profession as well as those already engaged in the profession: and
- To provide consulting and advisory services to public and private organizations.

To achieve the above aims and objectives, the Institute will perform the following activities under two wings:

1. Academic Wing, and
2. System and Support Wings.

### **2.1.1 Activities of the Academic Wing**

- To offer courses leading to diploma and masters degrees in the field of ICT.
- To initiate, organize and perform studies and research on practical applications of ICT.
- To promote and provide facilities for development of skilled manpower in ICT
- To provide short course and training to interested persons in the field of ICT
- To provide refresher course and training in emerging branches of ICT
- To hold conference, seminar, workshop and other events related to the development of ICT in the country
- To develop linkage and exchange programs with local and overseas organizations: and
- To publish books, journals, monographs etc.

### **2.1.2 Activities of the System and Support Wing**

- To promote the use of ICT in the university and the country
- To promote multidisciplinary development of computer applications
- To provide training to students, teachers, officers and employees of the university in relevant fields of ICT
- To produce software for indigenous use as well as export
- To plan, install, maintain and develop computer networks within the university and also links to other institutions in the country as well as the Internet
- To provide computing, infra structural and advisory services to students, officers and teachers of the university and
- To provide advice and physical assistance to different departments, institutes and officers of the university in matters related to the purchase, operation, maintenance and development of computer hardware and software.

## 2.2 Board of Governors

The overall responsibility for administration and management is entrusted on the Board of Governors. The Vice-Chancellor is the chairman of the Board of Governors. The Director and Associate Directors of the institute conduct the overall administration and management on the permission of the Vice-Chancellor. Board of Governors (BOG) consists of the followings:

- I. The Vice-Chancellor, Chairman.
- II. The Dean, Faculty of Electrical and Electronic Engineering.
- III. One Dean from among the remaining faculties nominated by the Syndicate.
- IV. One reputed personality nominated by the Syndicate.
- V. One external member nominated by the Vice-Chancellor from the ICT sector.
- VI. One external member nominated by the Vice-Chancellor from other sectors.
- VII. The Director of Administration and Research Services.
- VIII. One Professor of the Institute nominated by the Vice-Chancellor, and
- IX. The Director of the Institute, who shall also act as Member - Secretary to the BOG.

## 2.3 List of Personnel of IICT

1. Professor Dr. S. M. Lutful Kabir, Director; B.Sc. Engg.(EEE), BUET; M.Sc. Engg., BUET; Ph.D. , The University of Manchester, U.K.; (Computer Applications, Microprocessor and Microcontroller).
2. Professor Dr. Md. Abul Kashem Mia, Associate Director (Academic); B.Sc. Engg.(EEE), BUET. M.Sc. Engg.(CSE), BUET. M.S.(Information Science) Tohoku University, Japan. Ph.D. (Information Science) Tohoku University, Japan; (Algorithms, Parallel Processing, Graph Theory, Graph Visualization, Computational Complexity).
3. Mr. Md. Saiful Islam, Assistant Professor; B. Sc. Engg.(EEE), BUET; M. Sc. Engg.(CSE), Shanghai University, China; (Software Engineering, Database, Optical Communications)
4. Dr. Md. Liakot Ali, Assistant Professor; B.Sc. Engg.(EEE), BUET; M.Sc. Engg. (Electrical, Electronic and System Engg.), Universiti Kebangsaan Malaysia; Ph.D.(Electronic Engineering), Universiti Putra Malaysia; (VLSI Design and Testing, Microcontroller and Microprocessor).
5. Dr. Khaled Mahbub, Assistant Professor, B.Sc. Engg. (CSE), BUET, M.Engg. Dublin City University, IRELAND, Ph.D; (Software Engg.) City University London.
6. Mr. Md. Rubaiyat Hossain Mondal, Assistant Professor, B.Sc. Engg.(EEE), BUET, M.Sc. Engg. (EEE), BUET; (Communication.)
7. Mr. Rezaul Hoque Akanda, Senior Instrument Engineer; B.Sc. Engg.(EEE), BUET; M.Sc. Engg. (EEE), BUET; (Instrumentation, Networking, Resource Management).

8. Mr. Abdul Hasib, Lecturer (on leave); B.Sc. Engg.(EEE.), BUET; M.Sc.(Communication), University of Stuttgart, Germany; (Communication Network, Wireless Communication).
9. Mr. Mohammad Ashraful Anam, Lecturer; B.Sc. Engg. (EEE), BUET; (Communication, Networking, VLSI, Neural Network).
10. Mr. Fazle Elahi Faisal, Lecturer; B.Sc. Engg.(CSE), BUET (Computer Network, AI).
11. Ms. Shahin Akhter, Lecturer; B.Sc. Engg.(EEE), BUET (Communication, Computer Network).
12. Mr. Rafiqul Hoque, Assistant Programmer; B.Sc. Engg. (Mech.), KUET; M.Sc. Engg. (Mech. Engg.), BUET (Database, Networking).
13. Mr. Md. Salekul Islam, Assistant Maintenance Engg. B.Sc. Engg.(EEE), KUET, (Networking, Web Programming)

## 2.4 Research and Academic Committee

There shall be a Research and Academic Committee (RAC) consisting of the following members:

- Director of the institute;
- All Professors and Associate Professors of the Institute;
- Any other teacher from the institute or from outside who offers a course in a term will be member for that term;
- All Associate Directors of the institute;
- One nominee of the Board of Post-Graduate Studies (BPGS) of the Department of Computer Science and Engineering from among its members not below the rank of Associate Professor;
- One nominee of the BPGS of the Department of Electrical and Electronic Engineering from among its members not below the rank of Associate Professor;
- One member nominated by the Vice-Chancellor; and
- One nominee of the Committee for Advanced Studies and Research (CASR) from amongst its members.

The Director of the Institute shall be the chairman of the RAC. One of the members as decided by the committee shall act as Member Secretary.

The term of office of the nominated members shall be two years but they shall continue in office till their successors are nominated.

The function of the RAC shall be as follows:

- To develop the syllabuses and courses for the post-graduate studies;

- To deal with matters related to admission of students;
- To suggest a panel of names of paper setters and examiners in the subject or subjects concerned;
- To identify target groups for training, assess training needs and develop training strategies;
- To prepare annual programme on short course, training and workshop;
- To identify the areas of research on the basis of national need and formulate research plan;
- To review the research proposals submitted by teachers and technical personnel, or select experts for reviewing the proposal, if necessary;
- To recommend the research proposals to the Board Of Governor's (BOG) for its approval;
- To monitor the progress of ongoing research projects;
- To recommend to the BOG for the appointment of exceptionally reputed technical personnel with vast experience as Visiting Fellow in the institute, if it feels that the appointment would help the Research and Human Development activities of the institute, on such terms and conditions as the BOG may decide;
- To do such other things as are assigned or referred to it by the Vice-Chancellor, the BOG, or the Syndicate.

The RAC shall ordinarily meet at least four times a year and report the proceedings to the BOG. The time and place of meeting shall be fixed by the Director of the institute.

The quorum for the meetings of the RAC shall be one-third of members, fractions being counted as one.

At least seven clear days notice shall be given for all ordinary meetings of the RAC and the agenda papers shall be circulated at least twenty four hours before the meeting.

Extraordinary meetings of the committee may be convened with at least one day's notice, only when the nature of the business to be brought before committee, in the opinion of the chairman, necessitates an immediate action. Every member of the committee resident in Dhaka shall receive a notice of the extraordinary meeting and no business that is not of immediate urgency shall be transacted at the meeting.

The minutes of the meetings shall be circulated among the members within seven days of the meeting and shall be placed before the following ordinary meeting for confirmation.

The Research and Academic Committee (RAC) is responsible for preparing the syllabus, monitoring the progresses of different research projects.

## 2.5 IICT Resources and Establishments

The institute has a spacious lounge, office, one conference room with video conferencing facility connected via dedicated bandwidth, two lecture theatres, three PC classroom labs, one Network lab and one Multimedia lab. All classrooms, labs, and lecture theatres are air-conditioned. The supplied voltages of the computers are maintained at constant level with a centralized voltage stabilizer as well as by separate voltage stabilizers for each room.

The center extends its services through a good number of computers and peripherals. At present, the center has six network servers including an IBM RS/6000, 12 DELL and one Zenith HX and two Compaq servers. The networking platforms are UNIX (AIX, SCO, SOLARIS and Linux) Windows NT and Novell Netware. The Institute has also a good number of printers including 21400/800 lpm line printer, two Tally T6100, 3 laser printers and one OMR machine.

The institute has three modern PC class rooms each having PC, multimedia projector with audio visual capabilities. These classrooms are used by the post graduate students of IICT and also by different departments for their undergraduate programs. Besides, the institute has a very modern Network and Communication Laboratory, Multimedia and Graphics Laboratory and Hardware and Embedded System Laboratory.

Besides the class room PCs, the institute has more than 30 PCs and workstations. These are used for different computing purposes. The institute also acts as the Internet Service Provider for the university users. It is offering 24 hours internet connectivity to the BUET students and teachers through BUET's own VSAT. IICT has established two browsing rooms with (25+30) pc's for students. One is situated at IICT premise another one is at 2nd floor of central library building. IICT has built the fiber optic backbone for BUET campus and is now connected to the submarine cable network.

The institute sometimes arranges different short courses for internal and external personnel and students. Most commonly offered courses are object oriented programming like C/C++, Java, C#, Visual Studio .Net, Web programming, E-business, Database management system like ORACLE etc.

The library of the institute has a good collection of books and manuals around 3000 in number, as well as, number of computer related journals.

The normal office hour of the institute is from 8 am to 10 pm throughout the week except Thursday and Friday. However, the institute does operate 24 hours a day and on weekends to meet emergency requirements.

After meeting the internal services as far as practicable within its means, the institute also caters to external requests for computing services. The institute extends its support to various organizations such as Dhaka Electric Supply Company (DESCO), Bangladesh Chemical Industries Corporation, IMED, Jiban Bima Corporation, and different education boards, National University, Dept. of Primary Education of Government of Bangladesh, Bangladesh Telegraph and Telephone Board, Bureau of Man Power, Employment and training (BMET), Bakhrabad Gas

Systems Ltd. (BGSL), etc.



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### System and Support Wing of IICT

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#### **3.1 Introduction**

The System and Support Wing of IICT bears the responsibility of operation, maintenance and development of IT infrastructure of the university which has evolved into one of the most essential tools of modern technological education and research. Being congruent with the role of BUET as premier institution of technical education and research in the country, the System and Support Wing of IICT is devoted to incorporate state of the art of technology and knowledge regarding information and communication engineering in the development of infrastructure, enhancement of education and provision of research facilities. The following section illustrates few of the major tasks and achievements of the wing.

#### **3.2 Operation & Maintenance of VSAT & Internet Connectivity**

The System and Support Wing of IICT facilitates the internet connectivity to the university through VSAT. The institute initially started providing the services with a leased line connection from a local ISP about six years ago and through a radio-link based 64 kbps link obtained through BERNET project of University Grants Commission (UGC). In 2001 BUET installed its own VSAT in the premises of IICT. The present bandwidth of the VSAT circuit is 1.5 mbps downlink and 384 kbps uplink which is leased from SingTel Corporation of Singapore. Through this connectivity IICT provides internet services to the university. End users are mostly connected via LAN and for some remote users dial up connectivity is also provided.

#### **3.3 Internet Services, Web and E-mail**

The wing facilitates various kinds of internet services which include providing mail-services, hosting and maintenance of the official website of BUET including the web sites of different departments of the university and, making arrangements for internet browsing for the students and teachers of the institution.

### **3.4 Operation & Maintenance of Optical Fiber Campus Backbone Network**

In order to enhance the educational and research capacity, recently BUET installed optical fiber based campus backbone network. Based on Gigabyte Ethernet technology, the network connects the main functional components of the university including departments, administrative offices, laboratories and libraries. The operation of the network is powered by the core switch of NORTEL 8606 and Bay Stack switches at different core points. The first phase of installation of backbone network was completed in 2001. BUET has plans to extend the backbone to all residential areas within BUET campus including student halls.

### **3.5 Computing Facilities for the Students**

Through couple of modern and fully equipped classrooms and laboratories, the System and Support Wing of IICT satisfies the educational and computing needs of the faculties, researchers and students of the university. These classrooms are equipped with powerful computers, multimedia projectors, software etc. Also, all the classrooms are provided with intranet and Internet connectivity. There exist facilities for downloading, coping and printing of necessary documents at the laboratories and browsing rooms.

### **3.6 Students' Browsing Facility**

IICT, BUET has established two browsing rooms for students of BUET. One of these browsing rooms is located at IICT premises and the other is in 2nd floor of Central Library Building. Students of the university can use the facilities for academic and research purpose free of cost.

### **3.7 Research Facilities**

Through highly powerful computers, sophisticated equipments and rich software repository, the System and Support Wing of IICT facilitates high quality research work for the students of different departments of BUET as well as the graduate and postgraduate diploma students of the institute.

### **3.8 Hardware & Software Related Services**

With an objective of optimal utilization of the expertise of the institute, the wing provide consulting services to the departments, institutes and offices of the university in connection with procurement, operation and maintenance of the hardware and software. Recently the wing has initiated a project on development of central database for the university with an objective of automating various administrative and academic activities of the university.

### **3.9 Education Related Services**

In addition to providing computing and browsing facilities for the students of BUET, the wing also facilitates extra-curricular activities of the students like teaching and learning of hardware,

networking, database software and programming languages through TITAS program. It assists the faculties of institution by providing the facility of Optical Mark Reader (OMR) which is widely used for student evaluation purpose. Also, the wing extends its support for computer related facilities required for various examinations including the admission test of the university.

### **3.10 Partnership with CodeWitz Project**

The System and Support Wing has established a partnership with CodeWitz Project of Tampere Polytechnic University (TPU) of Finland to enhance the programming skill, particularly in C++ and JAVA, of the students of BUET through effective utilization of simulation, animation and visualization tools. The cooperation also provides the opportunity to develop such tools at IICT and share them with other CodeWitz partners.

### **3.11 Collaboration with Industry, Institutions & Other Universities**

The System and Support Wing of IICT has developed a framework for close cooperation for exchange of knowledge and technology with the leading persons in the industry and other institutions and universities through discussion, meeting and seminar.

### **3.12 Consultancy Services**

IICT has evolved into a Center of Excellence for providing high quality consultation services for information and communication related activities. The institute regularly provides the consultation and ancillary services in this regard to the government and private agencies. A list of few major projects, successfully implemented by the institute, is listed below.

- Computerization of Billing System of DESA (1980)
- Computerization of Primary Education Exam. System (1992)
- Computerization of Data Management System of UNHCR (1993)
- Computerization of Public Exam. (SSC & HSC) systems (1994)
- Computerization of Overall System of BTTB (1995)
- Computerization of Bangladesh Railway Ticketing System (1997)
- Automation of result processing and recruitment of primary school teachers (2000)
- Automation of Man Power Export processing of Bangladesh (2003)
- Eradication of hazardous child labor project (2003)
- Machine Readable Passport (MRP), Machine Readable Visa (MRV) and National ID Card Project (2004)
- Computerization of Examination System of Bangladesh Technical Education Board (2004)
- Prepaid Energy Meter Project (2004)

The following projects are partially installed and remaining portions are under development

- Computerization of Bakhrabad Gas Systems Ltd.(BGSL) (2004)
- Computerization of Jalalabad Gas Transmission and Distribution Systems Ltd. (2005)
- Data Acquisition System of Dhaka Electric Supply Company (DESCO) (2006)
- Establishment of e-Governance in Dhaka Electric Supply Company (DESCO) (2006)

## CHAPTER 4

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### Academic Wing of IICT

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#### 4.1 Courses Offered by IICT

Since the establishment on September, 2001, IICT has been running its programmes with great success and dedication. At the beginning there was only Post Graduate Diploma (PG. Dip.) programme in Information and Communication Technology (ICT). But its immediate success encourages the authority to launch for the Master's Program.

Currently the following programs are offered:

1. Post Graduate Diploma (PG.Dip.) in Information and Communication Technology (ICT)
2. M.Sc. Engg./M.Engg. in Information and Communication Technology (ICT)

Maximum no. of seats:	PG.Dip.(ICT)	60 (sixty)
	M.Sc. Engg. (ICT) / M.Engg. (ICT)	30 (thirty)

##### 4.1.1 Entrance requirements

1. For admission in PG.Dip. (ICT) Programme, a candidate
  - (a) must have either B. Sc. Engineering degree from any recognized University.  
OR,  
Master degree / Four year Bachelor degree in Computer Science, Information Technology, Physics or Mathematics from any recognized University.
  - (b) must have a minimum GPA of 3.50 out of 5.00 or a first division or equivalent in any one of S. S. C and H. S. C or in equivalent examinations and must not have a GPA less than 2.00 out of 5.00 or a third division or equivalent in any of the aforementioned examinations.
  - (c) must have at least 50% marks or a minimum GPA of 2.50 out of 4.0 or its equivalent in B. Sc. Engg. / Master degree / Four year Bachelor degree.

- (d) For the candidates having degrees from institutions other than BUET, their eligibility for appearing in the admission test will be decided by the equivalence committee of BUET.

2. For admission in M.Sc.Engg. (ICT) / M.Engg. (ICT) Programme, a candidate

- (a) must have Bachelor's degree in Computer Science and Engineering or Electrical and Electronic Engineering or Computer Engineering or Computer Science or Information Technology having at least 50% marks or minimum GPA of 2.5 out of 4.0 or its equivalent from any recognized university  
OR,  
PG. Dip. (ICT) / PG. Dip. (IT) having a minimum GPA of 2.65 out of 4.0 or its equivalent from any recognized university plus B. Sc. Engineering degree or Master's degree / four year Bachelor's degree in Physics or Mathematics.
- (b) must have a minimum GPA of 3.50 out of 5.00 or a first division or equivalent in any one of S.S.C. and H.S.C. or in equivalent examinations and must not have a GPA less than 2.00 out of 5.00 or a third division or equivalent in any of the aforementioned examinations.

#### 4.1.2 Credits to be earned for the degrees

For each of the programme, the minimum requirement for the degree is 36 credit hours.

There shall be two categories of students, namely, full-time students and part-time students. Students serving in different organizations may be admitted as part-time students with a written consent of the employer. A part-time student may be assigned a maximum of 9 credit hours of courses in any term. Full-time students must register for a minimum of 12 credit hours and a maximum of 15 credit hours per term. A full-time student shall not be allowed to be in the employment of any organization (even as part-time employee). However, they may be employed as Teaching/ Research Assistant at the University. If a full time student becomes an employee (full time or part time) of any other organization in the middle of a semester/term, he/she may, with the approval of the Head of the Department / Director of the Institute and his/her Employer, be allowed to continue as a full time student for that semester/term. A student may be allowed to switch from part-time to full-time or vice versa on the recommendation of the respective BPGS/RAC before the commencement of a semester/term.

#### 4.1.3 Application procedure

Prescribed Application Form and Information brochure will be available from the Registrars office (Academic Section) on cash payment of TK. 300/- per form or by sending Bank Draft for this amount in favor of Comptroller, BUET drawn on Sonali Bank, BUET branch, Dhaka along with a 255 mm x 115 mm (10 inch x 4.5 inch) self-addressed envelope affixed with a postal stamp of TK. 6/- (TK Six only). Applicants must submit the completed application form along with attested photocopies of all certificates, transcripts/ mark sheets/ grade sheets, testimonials and character certificate from the institution last attended. Candidates in employment must apply through their employers for both part-time and full-time enrolments.

#### 4.1.4 Selection procedure

- The applications will be scrutinized by the Institute and a list of eligible candidates will be displayed in the Institutes Notice Board. The candidates will have to appear in tests conducted by the Selection Committee of the institute
- The written test will be of multiple choice type and there will be a total of 50 Questions.
- On the basis of the result of the written test, a list of preliminarily selected candidates will be published. A practical test of successful candidates in written test will be held. The practical test will be based on computer fundamental.

#### 4.1.5 Admission test

##### PG.Dip

Written test for the PG. Dip. (ICT) program generally takes place on the month of November, every year. The test will be of multiple choice type and there will be a total of 50 questions.

Section wise distribution will be as follows:

Section 1: IQ	- 25 questions
Section 2: English	- 15 questions
Section 3: Computer Fundamental and Programming Skills	- 10 questions

A candidate must pass in each section individually. The pass mark is 40%. There will not be any negative mark for the wrong answers. A practical test (on Computer Fundamental and Programming Skill) is taken for successful candidates in written test.

##### Master's Degree

A descriptive type written test will be conducted for the Master's admission. The topics that will be covered are as follows:

- Programming Languages
- Computer Networks
- Data Structures and Algorithms
- Database Management System
- Computer Architecture
- Operating systems
- Communication
- Digital Logic Design
- Basic Electrical Circuits

The test generally takes place on the month of March and/or September every year. There will be 5 questions in each topic. That is, a student will answer 30 questions (maximum). Each question will be of ten marks. The duration of the test will be one and half an hour. Details of the admission test may also be found at IICT office or at the website: [www.buet.ac.bd/iict](http://www.buet.ac.bd/iict).

#### **4.1.6 Fees and Others**

The selected candidates have to pay the following amount as described below:

- Admission fee - Tk. 1000/-
- Course fee - Tk. 500/- per credit hour
- Caution money - Tk. 5000/- (refundable after the completion of the program)

#### **4.1.7 Timing of the classes**

Normally the classes for the programme held from 4 PM during the working days. But under special circumstances, classes may be held at any other time and days.

#### **4.1.8 Tentative calendar for the forthcoming session**

Number of terms for PG Diploma programme will normally be three. The tentative calendar of the terms are as follows:

- 1st term/semester - From December to March
  - 2nd term/semester - From April to July
  - 3rd term/semester - From August to November
- Number of semesters for Master's programme will normally be two.

#### **4.1.9 Allowable duration of the programs**

A student must complete the PG Diploma within 3 academic years and Master's within 5 academic years from the date of the first admission in the respective program.

### **4.2 Research Activities**

IICT encourages its students and teachers to research on IT related topics like data structure and algorithm, software engineering, information system design, computer network, database and distributed systems, e-governance, developing teaching and learning methodologies in an academic environment, fuzzy logic systems, machine translation, pattern and speech recognition etc. Students are involved in the research through courses or group activities. Students of MSc. Engg or M. Engg. are bound to take thesis under the course no. ICT 6000. Teachers are also involved into research either through individual effort or group work. To provide research materials, IICT allows its students to access Internet or library facility. In addition, teachers can access the facility of central library. IICT library and central library have a good number of books and updated journals on IT related topics. IICT is going to publish a research bulletin very soon to encourage its students and teachers to involve into research activities. The bulletin will be published in every 6 months and it will contain writings of its students, teachers as well as external researchers. Moreover IICT regularly arranges talk and seminar on IT related topics to enrich the knowledge of its students. Famous researchers and professionals from home and abroad usually deliver the talks. Recently IICT arranged a very successful international Conference titled as "International Conference on Information and Communication Technology 2007 (ICICT 2007)". The Conference was able to raise huge interest and opinion among its participants. The conference gathered feedback of participants and speakers and came out with some suggestions, which was delivered to the ministry of science and information and communication technology for future implementation.

## CHAPTER 5

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### Rules and Regulations for Academic Programs

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#### 5.1 Academic calendar

There will be 13 lectures for each semester. If for any reason such as Hartal, strike, natural calamities normal classes could not be held, make up classes will be taken on the next Thursday or Friday. The evaluation of a course will be carried out by taking three examinations. There will be two mid-term examinations and one final examination. The first mid-term examination will be held in the 5th week and the second one in the 9th week. The mid-term examination will be held during the normal class hour. The duration of the mid-term examination will be one hour.

At the end of 13 weeks of classes, the final examination will be held on the following week without any break (preparatory leave). The duration of final examination for each course will be one and half hour.

The result of the term-final examination and the registration procedure will be finished within the week following the final examination. The classes for the next semester will start on the next week.

The normal class time will be between 4:00 PM to 8:30 PM. Marks Distribution:

Mid term I	30%
Mid term II	30%
Final exam	40%

#### 5.2 Registration Procedure

Students must register for each class in which they will participate. Each student will fill up his/her Course Registration Form in duplicate. One copy of the Course Registration Form will be submitted to the Registrar's Office and the second copy will be given to the students.

### 5.3 Calculation of GPA

Grade Point Average (GPA) is the weighted average of the grade points obtained in all the courses passed/completed by a student. For example, if a student passes/completes five courses in a semester having credits of C1, C2, C3, C4 and C5 and his grade points in these courses are G1, G2, G3, G4 and C5 respectively then,

$$GPA = \frac{\sum C_i G_i}{\sum C_i}$$

### 5.4 Conduct and Discipline

A student shall conform to a high standard of discipline and shall conduct himself within and outside the precincts of the university in a manner befitting the students of an university of national importance. He should show due courtesy and consideration to the employees of the university, good neighborliness to his fellow students and the teachers of the university and pay due attention and courtesy to visitors.

#### 5.4.1 Fees

Admission fee	Tk. 1000/=
Caution money	Tk. 5000/=
Course registration fee (per credit hour)	Tk. 500/=

### 5.5 Restrictions

A student participating in the program will not be considered as a regular student of BUET. Any other benefit except directly related to the program during class hours will not be permissible. The following restrictions will apply to both PG. Dip. and Master's students:

- Accommodations in the residential halls and availing university transport services.
- Use of central library. However, they will be entitled to use institute's own library.
- Participation in any of the student's union activities.
- Availing university medical facilities.

#### 5.5.1 Extract from Ordinance

- For the PG. Dip. a student must earn a minimum of 36 credit hours including a project of 6 credit.
- For the degree M.Sc. Engineering a student must earn a minimum of 36 credits including a thesis of 18 credits.
- For the degree M. Engineering a student must earn a minimum of 36 credits including a project of 6 credits.

- The minimum duration of the PG. Dip. course shall normally be three terms / semesters. A candidate for the PG. Dip. must complete all the requirements for the diploma within three academic years from the date of his/her first admission in the respective program.
- The minimum duration of the M.Sc. (ICT) course shall normally be three semesters. A candidate for the Master's degree must complete all the requirements for the degree within five academic years (Session) from the date of the first admission in the program.
- There shall be two categories of students, namely, full-time students and part-time students.
- Students, serving in different organizations, may be admitted as part-time students with a written consent of the employer. A part-time student may be assigned a maximum of 9 credit hours of course work.

Final grades for courses shall be recorded as follows:

<b>Grade</b>	<b>Merit description</b>	<b>Grade Points</b>
A (Plus)	Excellent	4.00
A	Very Good	3.50
B (Plus)	Good	3.00
B	Average	2.50
C	Pass	2.00
F	Failure	0.00
I	Incomplete	-
S	Satisfactory	-
U	Unsatisfactory	-

All final grading to be reported to the Controller of Examinations will be in the letter grade system as detailed below:

<b>Numerical grade Point</b>	<b>Letter Grade</b>	<b>Grade</b>
90% and above	A (Plus)	4.00
80% to below 90%	A	3.50
70% to below 80%	B (Plus)	3.00
60% to below 70%	B	2.50
50% to below 60%	C	2.00
Below 50%	F	0.00

- Full-time students must register for a minimum of 12 credit hours and a maximum of 15 credit hours per term / semester. A full-time student shall not be allowed to be in the employment of any organization (even as a part-time employee). However, they may be employed as Teaching / Research Assistant at the University.
- A student on recommendation of the relevant BPGS or the RAC and as approved by the CASR may be allowed a transfer of credits of the courses completed by the student at a recognized institution provided that the courses were not taken earlier than three calendar years from the date of his first enrolment in the respective program at BUET and that the student obtained a minimum GPA of 3.0 out of 4.0 or its equivalent and that the courses are equivalent to the approved courses of BUET.

- The qualifying requirement for the diploma or degree is that a student must earn a minimum grade point of 2.65 based on the weighted average in his/her course works.
- Courses in which the student gets F grades shall not be counted towards credit hour requirements and for the calculation of Grade Point Average (GPA).
- Grade I is given only when a student is unable to sit for the examination of a course at the end of the term /semester because of circumstances beyond his control. He/she must apply to the Head or Director of the concerned Department or Institute within one week after the examination to get an I grade in that course. It must be completed within the next three terms / semesters, otherwise, the I becomes an F grade. He/she may, however, be allowed to register without further payment of tuition fees for that course.
  
- Officially withdrawn from a course -A student may withdraw officially from a course within two working weeks of the commencement of the term / semester otherwise his/her grade in that course shall be recorded as F unless he/she is eligible to get a grade of I. A student may be permitted to withdraw and change his/her course within the specified period with the approval of his/her Adviser, Head of the department or the Director of the Institute and the respective teachers(s) concerned.
- If the cumulative number of F grades obtained by the student is three or more in the same or different subjects taken together, he/she shall not be allowed to continue in the program.
- If at the end of the second or any subsequent semester / term, the cumulative GPA falls below 2.5 he/she shall not be allowed to continue in the program.
- Caution money may be refunded if the student withdraws officially from all the courses including project or at the end of his academic program and the amount will be determined from the statement of clearance from all Departments / Institutes /Offices.

## CHAPTER 6

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### Course Structure and Outline

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#### 6.1 Present Structure of Courses

##### 6.1.1 For Postgraduate Diploma in Information and Communication Technology

###### Summary

Group A (Core Courses)	3x6=18 credits
Project	6 credits
Group B(Optional Courses)	3x4=12 credits
Total Credits	36 credits

###### Group A

All of the following to be taken

Course Number and Name	Credit Hours
ICT 5100 (Project)	3
ICT 5101 (Programming Concepts)	3
ICT 5102 (Data Structure and Algorithm)	3
ICT 5103 (Database Design and Management )	3
ICT 5104 (Introduction to Telecommunications )	3
ICT 5105 (Data Communications)	3
ICT 5106 (Computer Networks )	3

**Group B**

Any four of the following to be taken,  $3 \times 4 = 12$  credit hours.

Course Number and Name	Credit Hours
ICT 5201 (Operating System Concepts)	3
ICT 5202 (Visual Programming)	3
ICT 5203 (Web Technologies, Protocols, and Applications)	3
ICT 5204 (Multimedia Design and Development)	3
ICT 5205 (Client Server Technologies)	3
ICT 5206 (Electronic Commerce)	3
ICT 5207 (Information System Analysis and Design)	3
ICT 5208 ( Software Engineering and Application Development)	3
ICT 5209 (Software Quality Management)	3
ICT 5301 (Information System and Network Security)	3
ICT 5302 (Advanced Internet Technologies)	3
ICT 5303 ( Network Programming and Management )	3
ICT 5304 (Digital Communications)	3
ICT 5305 (Mobile Communications)	3
ICT 5306 (Software and Database in Telecommunication)	3
ICT 5307 (Embedded System Design)	3
ICT 5308 (Network System Design)	3
ICT 5309 ( Optical Communication)	3

**6.1.2 For Master's in Information and Communication Technology****Summary**

Courses	M.Sc. Engg. Credits	M. Engg. Credits
Theory Courses	$3 \times 6 = 18$	$3 \times 10 = 30$
Thesis/Project	18	6
Total Credits	36	36

Any six of the following to be taken for M.Sc. Engg.,  $3 \times 6 = 18$  credit hours.

Any ten of the following to be taken for M.Engg.,  $3 \times 10 = 30$  credit hours.

Course Number and Name	Credit Hours
ICT 6511 (Graph Theory and Application)	3
ICT 6512 (Parallel Algorithms)	3
ICT 6513 (VLSI Layout Algorithms)	3
ICT 6514 (Bioinformatics Computing)	3
ICT 6521 (Advanced Database Systems)	3
ICT 6522 (Data Warehousing and Mining)	3
ICT 6531 (Computational Linguistics)	3
ICT 6532 (Statistical Machine Translation)	3
ICT 6533 (Speech Processing)	3
ICT 6534 (Speech Recognition)	3
ICT 6535 (Advanced Artificial Intelligence)	3
ICT 6536 (Neuro-Fuzzy Systems)	3
ICT 6541 (Applied Cryptography)	3
ICT 6543 (Computer Graphics and Animation)	3
ICT 6544 (Distributed Systems)	3
ICT 6611 (Advanced Digital Communication)	3
ICT 6612 (Advanced Optical Communication)	3
ICT 6613 (Mobile and Wireless Communications)	3
ICT 6615 (Teletraffic Engineering)	3
ICT 6616 (Radio Frequency Technology)	3
ICT 6621 (Advanced Networking)	3
ICT 6632 (Advanced VLSI Design)	3
ICT 6633 (Advanced VLSI Testing)	3
ICT 6641 (Advanced Embedded System Design)	3
ICT 6642 (Real Time Computing for Embedded System)	3
ICT 6651 (Advanced Digital Signal Processing)	3
ICT 6900 (Special Topics Related to ICT)	3

## 6.2 Detail Outline of Courses

### 6.2.1 For Postgraduate Diploma in Information and Communication Technology

#### ICT 5101: Programming Concepts: 3 Credits

Introduction to programming and logic flow, procedural versus object oriented programming, data types, variables, constants, operators, expressions, input-output, control structures, arrays, functions, pointers, file access, structures, dynamic memory allocation, classes, objects, constructor and destructor, inheritance, polymorphism, files, exception handling.

#### ICT 5102: Data Structure and Algorithm: 3 Credits

Introduction to elementary data structures: arrays, records, linked lists, stacks, queues, trees; Complexity analysis of algorithms; Basic search and traversal techniques; Sorting algorithms; Methods for the design of efficient algorithms: recursion, divide and con-

quer, greedy method, dynamic programming; Graph algorithms.

### **ICT 5103: Database Design and Management: 3 Credits**

Introduction to database; Relational model: structure, relational algebra, SQL and advanced SQL, Database design and the entity-relationship model, Relational database design and normalization, application design and development, indexing, Database storage and file structure, transaction management, concurrency control recovery management, object database and database administration.

### **ICT 5104: Introduction to Telecommunications: 3 Credits**

Overview of telecommunication: history, evolution, convergence of telecommunication and data networks, standards; Basics of communication systems: modulation, multiplexing; Switching system: circuit switching, packet switching; Voice over Internet Protocol (VoIP), Fax over IP network, voice over frame relay, and ATM; Telephony: operating principles, telephone apparatus, description of the modern phone; Telephone switching systems: PBX, Centrex, ACDs, call centers, computer integration; Data communication equipment: introduction to terminals, modems, RS-232 and other interfaces, modem types; Tele-Traffic analysis; Cellular telephony: Frequency reuse, frequency management, channel alignment, handoffs strategies, FDMA, TDMA, CDMA and GSM, Introduction to satellite communication, Optical fibre communication, Submarine cables, Digital Radio Microwave, etc.

### **ICT 5105: Data Communications : 3 Credits**

Introduction to data communication and networks; transmission media, signals, noises, modulation and demodulation, synchronous and asynchronous transmission, line encoding, error detection and correction, RS 232 interface, HDLC, flow control and error control; Channel multiplexing; Data network: point to point connections, circuit-switched, message switched and packet switched networks, WANs, ISPs and LANs, differences in ownership, speed and cost; Types of communication: client server communication, broadcast, unicast and multicast modes, simplex, duplex and half duplex information flow; Bandwidth: distribution of bandwidth, discrete bandwidth requirements, implications of other factors; Internet, OSI reference model, TCP/IP reference model, TCP/IP architecture.

### **ICT 5106: Computer Networks: 3 Credits**

Overview of LAN concepts, media, collision and broadcast; MAC address; Token ring, Fiber Distributed Data Interface (FDDI), Ethernet and Carrier Sense Multiple Access Collision Detect (CSMA/CD), IEEE 802.3., LAN topology; Network layer: internet-working, routing, IPv4 and IPv6 addressing, subnetting, VLSM, NATPAT, ACL, ARP and RARP, DHCP, RIP, IGRP and EIGRP, OSPF; Upper layers of OSI model; Wireless LAN: Ad hoc, infrastructure networks; WAN services: analog dial-up, ISDN dial-up, dedicated leased line, X.25, frame relay, ATM; IEEE802.11: physical layer, framing, multiple access techniques, blue-tooth, IEEE 802.15; Broadband wireless: Wireless ATM, 802.16; local multipoint distribution service (LMDS), Multichannel Multipoint

Distribution System (MMDS); Network protocols: mobile IP, cellular IP, mobile Ad hoc networking.

### **ICT 5201: Operating System Concepts: 3 Credits**

Overview of operating system and its role in computer systems; Process: process model, inter-process communication; thread model; CPU scheduling; Memory management, virtual memory, address translation; File systems: files, directories, protection and security; Input, output; Deadlock; Introduction to UNIX, UNIX kernel, UNIX commands, services, device structure, memory structure, process and jobs, file system and file management, vi and emacs editors, shell programming; LINUX: user management, privilege, using rpm, using configuration files.

### **ICT 5202: Visual Programming : 3 Credits**

Concepts of visual programming; Data types, variables and expressions, control structures; Classes and objects, constructors; Inheritance, packages and interfaces; Exception handling; Collection classes: array, vector; Threads; GUI development; applets; Graphics and multimedia; Servlet; JDBC; Java beans; Java server page; Java networking.

### **ICT 5203: Web Technologies, Protocols, and Applications: 3 Credits**

Web architecture and HTTP: history and architecture of the World Wide Web, overview of the Hyper Text Transfer Protocol, other related protocols; Hyper Text Mark Language (HTML): concept of markup, overview of HTML (table, form, frame, window, link etc.); Client side scripting: variables data types, control structure, functions, Document Object Model (DOC), event handlers, properties methods, cookies; Server side scripting: concepts, variables, data types, control structure, functions, objects; Database: content generation, data exchange; Regular expressions, mails, cookies, sessions; Middleware: object management architecture, object request brokers (CORBA, OLE/COM), services (trading, naming, event, transaction, security), interorb protocols (e.g. the Internet Interorb protocol).

### **ICT 5204: Multimedia Design and Development : 3 Credits**

Introduction to multimedia, image, sound, video formats and their different properties, compression, playing and recording techniques, merits and demerits, conversions between different formats and their combinations; Multimedia authoring, introduction to web and HTML, basic HTML tags design principles; Drawing: basic image properties, image manipulation, layers, colors, text, texture, brightness, contrast, filters and effects; Interactive application development using multimedia tools.

### **ICT 5205: Client Server Technologies: 3 Credits**

Introduction, components of client server architecture, middleware, socket, Remote Procedure Call (RPC), Distributed Computing Environment (DCE), Common Object Request Broker Architecture (CORBA), Java Remote Method Invocation (RMI), Enterprise

Java Beans (EJB), distributed data management, client-server application development, storage management, security and user management, backup and recovery, performance tuning.

**ICT 5206: Electronic Commerce: 3 Credits**

Overview of electronic commerce, business models; E-commerce channels: portals, auctions, communities, marketplace; Managing the marketplace: Demographics and advertising; Customer relationship management, web services for B2B and B2C e-commerce, electronic payment systems; Network security, cryptography, digital certificates; Markup for e-commerce: ebXML, M-commerce, L-commerce, wireless and U-commerce, digital money and electronic banking; Ethical, legal, and regulatory environment: Intellectual property, copyright, trademark, patents.

**ICT 5207: Information System Analysis and Design: 3 Credits**

Different types of information systems, attributes of information, roles, tasks and attributes of a system analyst, sources of information, information gathering techniques, handling of missing information, steps of system analysis, different types of feasibility analysis; Design of an information system: process modeling, logic and timing modeling, conceptual data modeling; Project effort analysis method, designing user interfaces, database and file design, project team organization, project management and documentation, system installation and commissioning, analysis of system maintenance and upgrading; Ethics, privacy control and security; Case study of an information system.

**ICT 5208: Software Engineering and Application Development : 3 Credits**

Software engineering paradigms, process models, complexity models, requirement engineering, different models of effort, schedule-and cost-estimation, risk analysis and management, project management, different software design methodologies, verification and validation, testing philosophy and methods, software configuration management, software metrics, software reliability and availability, software maintenance and software re-engineering, development of applications using software engineering concepts.

**ICT 5209: Software Quality Management: 3 Credits**

Software quality, software process and process metrics, different quality metrics of software; Verification and validation tasks and techniques, software error and defect removal, SQA management and models, statistical quality control; Quality management system: ISO 9000, ISO 9001, and IEEE 12207 Standards; Compliance criteria of different standards: 9000/AS-3563 and ISO 9001, Capability Maturity Model (CMM), People Capability Maturity Model (P-CMM); Benchmarking and certification.

**ICT 5301: Information System and Network Security: 3 Credits**

Fundamentals of cryptography, security for communication protocols, security for operating systems and mobile programs, and security for electronic commerce, passwords

and offline attacks, DES, RSA, DSA, SHA, SSL, CBC, IPSec, SET, DDOS attacks, biometric authentication, PKI smart cards, S/MIME, privacy on the Web, viruses, security models, wireless security, and sandboxing.

### **ICT 5302: Advanced Internet Technologies: 3 Credits**

Introduction to the Internet: Introduction to XML, XHTML, XSL, integrating JavaScript and XSL; Internet Address, sockets; Application specific protocols and services: authentication, domain name services (DNS), electronic mail, world wide web, web caching, network management, internet control message protocol (ICMP), file transfer protocol (FTP), secured remote access; Voice over IP and its protocols, Next generation of internet, Revolutionary application of internet.

### **ICT 5303 Network Programming and Management : 3 Credits**

Concepts of network operating system, streaming technology, inter process communication (IPC) between application programs, Abstract Syntax Notation One (ASN.1), TELNET, File Transfer Protocol (FTP), simple mail transfer protocol (SMTP), Simple Network Management Protocol (SNMP), network programming, socket-level interface, algorithm and issues in client / server software design; installation, administration and management of commercial network software packages; Network information service (NIS) and network file system (NFS); State-of-the-art network management tools and systems, high speed LAN, MAN, network management and troubleshooting techniques.

### **ICT 5304: Digital Communications: 3 Credits**

Overview of different types of communication networks and their architecture; A/D conversion; GIF, JPEG, PNG; Audio coding for fixed telephone network and speech coding for mobile communications; Image and video coding: JPEG and MPEG; Channel coding: scrambling, convolution coding, cyclic redundancy checks, scrambling and interleaving; Modulation schemes: ASK, PSK, FSK, and GMSK. Modulation for local access: ADSL, DSL; Multiple access technologies, high speed PSTN access technology; Routing strategies, numbering schemes, Switching techniques: space switching, store and forward switching; Routing strategies; Numbering schemes; VSAT and satellite communication; Audio and video conferencing technique, Cable and satellite TV networks, HDTV transmission.

**ICT 5305: Mobile Communications: 3 Credits**

An introduction to ubiquitous communication; Wireless transmission: frequencies for transmission, International Regulations and Regulatory Authorities, signals, antennas, signal propagation, multiplexing, modulation, spread spectrum; Medium access control: SDMA, FDMA, TDMA, CDMA; Radio network planning; Fundamentals of cellular telephony: concept of cellular communications, frequency reuse, cell splitting, registration, terminal authentication, handoff; GSM and GPRS: services, system architecture, radio interface, protocols, handover, security; Next generation mobile telecommunication systems: 2.5G systems (EDGE, TETRA), 3G systems (UMTS, UTRAN), 4G and beyond; Wireless LANS and personal area networks: 802.11, IrDA, Blue-tooth, data services: WAP, mobile IP.

**ICT 5306: Software and Database in Telecommunication: 3 Credits**

Introduction to hardware and software evolution; Software components: database, distributed database, real-time software, mapping of software components etc; Constraints on the software components: real-time behavior, service continuity, hardware limitations, software and hardware integration and dimensioning etc; Telecommunication software development: examples of life cycles; Methods and tools for: requirement capture, analysis, specification, architecture, design and development; Interfaces definition: problem overview, transparency of distribution; System tests; Database in telecommunication systems, database environment, relational and object databases; Database planning, design and administration; Database trends in telecommunication: real-time database, multimedia database, WWW servers and database, 3D image handling in database, multimedia and existing RDBMS.

**ICT 5307: Embedded Systems Design: 3 Credits**

Concepts, classifications; Characteristics; Requirements; Introduction to embedded system design process, Unified Modeling Language (UML); Embedded micro-controller cores; Embedded memories; Technological aspects; Interfacing between analog and digital blocks; Signal conditioning, digital signal processing, sub-system interfacing; Interfacing with external systems, user interfacing; Design trade-offs, thermal considerations; Networked embedded systems: the I2C bus, the CAN bus, the FlexRay; Example of applications.

**ICT 5308: Network Systems Design: 3 Credits**

General design process, issues, documents. LAN design: Media, devices and tools; LAN topology, star and extended star, ring, bus; Physical layout, network map, cables and conduits, labeling; Firewall. Wireless LAN: Issues and motivations; standards, IEEE 802.11; Transmission techniques: Infrared, spread spectrum and narrow band microwave; Application areas: Extension, cross building interconnect, nomadic access, ad hoc networks; Equipments and devices. WAN design: Types and technologies; Equipments and devices; Structured design approach, considerations of design, selection and placement of devices; Evaluation of network performance, security, reliability, and management capa-

bilities.

### **ICT 5309: Optical Communication: 3 Credits**

Introduction; Light propagation through optical fiber: Ray optics theory and mode theory; Optical fibers: Structure, conditions of propagation, attenuation, pulse dispersion, fiber joint and fiber couplers; Light sources and transmitters: Principle of light emission, modulation bandwidth and spectral properties; Photodiodes and receivers: Operational principles, electrical bandwidth, noise and sensitivity; Optical amplifiers: Construction, amplification and noise; Optical communication systems with analog and digital modulation formats: performance and system budgets; Multichannel systems.

## **6.2.2 For Master's in Information and Communication Technology**

### **ICT 6000: Thesis for M.Sc. Engg. (ICT): 18 Credits**

**Project for M. Engg. (ICT): 6 Credits**

### **ICT 6511: Graph Theory and Application: 3 Credits**

Introduction to graphs and digraphs; Fundamental concepts: isomorphism, adjacency and connectivity; Trees, spanning trees, shortest paths, distances in graphs; Hamiltonian and Eulerian graphs, Travelling Salesman problem, Chinese Postman problem; Matchings and covers: Hall's theorem, marriage theorem, optimal assignment, vertex covers, edge covers; Connectivity and cuts: vertex and edge connectivity, Menger's theorem, Max-flow Min-cut theorem in networks; Graph coloring: vertex coloring and edge coloring, k-chromatic graphs, application to scheduling; Planar graphs: embeddings, dual graphs, Euler's formula, Kuratowski's theorem; Perfect graphs.

### **ICT 6512: Parallel Algorithms: 3 Credits**

Introduction, parallel processing, parallel models, performance of parallel algorithms, work-time presentation framework; Basic techniques: Pointer jumping, balanced trees, divide and conquer, pipelining, partitioning, symmetry breaking; List ranking, Euler tour technique, tree contraction; Parallel searching, merging and sorting; Connected components; Minimum spanning trees; Bi-connected components; Simulation between PRAM models: EREW, CREW and CRCW.

### **ICT 6513: VLSI Layout Algorithms: 3 Credits**

Introduction: VLSI design process, layout styles, difficulties in physical design, definitions and notations; Circuit Partitioning: problem definition, cost functions and constraints, Kernighan-Lin algorithm and its variations, simulated annealing; Floorplanning: problem definition, models, cost functions and constraints, cluster growth, simulated annealing, dual graph technique; Placement: problem definition, models and cost functions, approaches to placement; Grid routing: problem definition, cost functions and constraints, maze routing algorithms, line search algorithms; Global routing: problem

definition, cost functions and constraints, routing regions, sequential global routing, hierarchical global routing; Channel routing algorithms; Layout generation.

**ICT 6514: Bioinformatics Computing: 3 Credits**

Introduction to the genome: DNA, RNA, amino acids, and proteins; Information flow from the genome: genes, transcription, and translation; Integration of biological data: data integration systems, biological queries, query processing, data warehouses, and data visualization; Genome and protein sequencing and analysis, spectrum graphs; Clustering and classification: microarrays, gene expression analysis, hierarchical clustering, k-means clustering, clustering and classification algorithms; Drug discovery: technologies and strategies, identification of drug target molecules, drug design approaches.

**ICT 6521: Advanced Database Systems: 3 Credits**

Object-oriented database systems, XML, database and the web, data management in distributed mobile computing environment, data broadcasting, text database, digital library design and implementation; Multimedia database: Basic concept, design and optimization of access strategies; parallel database, spatial database, temporal database.

**ICT 6522: Data Warehousing and Mining: 3 Credits**

Data warehouse introduction, evolution of decision support system, Data warehouse environment, data model, design, Data warehouse technology, Data loading, clean up and transformation, Data cube and OLAP, Data mining introduction, classification, clustering, mining association rules, Data mining tools and applications, Data visualization.

**ICT 6531: Computational Linguistics: 3 Credits**

Introduction; Syntactic processing: Grammars and parsing, augmented grammars, grammars for natural language, parsing, ambiguity resolution; Semantic interpretation: Semantics and logical form, linking syntax and semantics, scoping; Context and world knowledge: Knowledge representation and reasoning, local discourse context and reference, using world knowledge, conversational agent.

**ICT 6532: Statistical Machine Translation: 3 Credits**

Introduction: Statistical versus structured natural language processing (NLP), basic statistics and statistical model, linguistics essentials, corpus-based NLP; Models and techniques: Collocations, statistical Inference, word sense disambiguation, lexical acquisition, Markov models; Grammar: Part-of-speech tagging, probabilistic context free grammars, probabilistic parsing; Applications and techniques: Statistical alignment, clustering, information retrieval, text categorization.

**ICT 6533: Speech Processing: 3 Credits**

Speech production models: Acoustic theory of speech production, discrete-time speech model, lossless model of the vocal tract; Speech perception, digital processing of speech

signals: Short-term processing of speech, linear prediction analysis, cepstral analysis; Speech coding: LPC, MRA, enhancement, human auditory system, quality assessment, speech synthesis; Speaker recognition and verification systems.

### **ICT 6534 Speech Recognition: 3 Credits**

Introduction; Modelling human speech perception: Auditory, neural and cognitive processing, pattern matching, linguistic processing; Representations of speech signal: Band-pass filter energies, formants, LPC and ARMA, cepstrum and mel-cepstrum, auditory-model based representations, difference coefficients, comparison of parametric representations; Recognition modes and modalities: Speaker dependency, isolated and continuous words, vocabulary size, speaking environment, perplexity, realtime operation; Stochastic models, linguistic models, prosodic knowledge sources; Knowledge-based approaches: Templates versus features, segmentation, labelling, fuzzy reasoning; Stochastic approaches: Hidden Markov Models (HMM), training and testing algorithms; Connectionist approaches: Neural networks, learning algorithms; Applications: Dictation systems, voice-voice-based communications, system control, security systems, speaker verification.

### **ICT 6535: Advanced Artificial Intelligence: 3 Credits**

Introduction; Advanced search techniques in AI, knowledge based system design, advanced plan generating systems; Probabilistic Reasoning, decision networks; Making complex decisions: Sequential decision problems, partially observable Markov decision problems (POMDPs); Multiple agent theory: Cooperation among multiple agents; Learning from observations: Inductive learning, decision trees, ensemble learning; Knowledge in learning: Use of logic, explanation based learning, inductive logic programming; Statistical learning: Complete data, hidden nodes (EM method), instance based learning, neural networks and neural belief networks; Fuzzy logic and genetic algorithm.

### **ICT 6536: Neuro-Fuzzy Systems: 3 Credits**

Overview of artificial neural networks; Neuro-Models; Simple neural networks; Multilayer neural networks: Multilayer Perceptrons (MLP), logistic activation function, back-propagation algorithm; Neural network applications; Overview of fuzzy system; Crisp sets to fuzzy sets; Operations on fuzzy sets, fuzzy arithmetic, fuzzy relations; Applications.

### **ICT 6541: Applied Cryptography: 3 Credits**

Overview of cryptography: terminology, steganography, computer algorithms; Protocol building blocks: one way function, hash function, digital signatures, random and pseudo-random sequence generation; Basic protocols: key exchange, authentication, formal analysis of authentication and key-exchange protocols, secret splitting, secret sharing, cryptographic protection of databases; Intermediate protocols: timestamping services, subliminal channel, different types of signatures, computing with encrypted data; Advanced protocols: zero knowledge proofs, blind signatures, identity based public key

cryptography, digital certified mail, simultaneous exchange of secrets; Cryptographic techniques: key length, key management issues such as generating, transferring, storing, updating, backup and destroying of key; Cryptographic algorithms: DES, newDES, IDEA, double encryption, triple encryption, public key algorithms; Implementation of cryptographic algorithms.

### **ICT 6543: Computer Graphics and Animation: 3 Credits**

Introduction to computer graphics; Viewing model; Transformations: Rotation, translation, and scaling; Rendering techniques: Scan conversion, clipping, filling polygon; Hidden line and hidden surface removal; Illumination and shading, texture mapping; Animation techniques: Mesh based system, skeletal animation system; Animation models, fractals.

### **ICT 6544: Distributed Systems: 3 Credits**

Introduction, communication model: Socket, Remote Procedure Call, Remote object invocation, message oriented communication; Naming service; Clock synchronization, distributed object based system: CORBA, distributed COM; Distributed file system, replication, distributed transactions; Security management, recovery.

### **ICT 6611: Advanced Digital Communication: 3 Credits**

Characteristics of different types of channels, storage channels; Digital modulation schemes, Digital transmission: Mapping, impulse shaping, receiver design, inter-symbol interference, eye diagram, noise, symbol error probability for multilevel transmission, partial response technique; Equivalent baseband channel; Equalizer, adaptive equalizer; System design with joint Nyquist and matched filter condition; Orthogonal signals, correlation receiver and equivalent matched filter receiver; Optimum detection: Bayes, Maximum Likelihood (ML) and Maximum A posteriori Probability (MAP) detection, ML symbol by symbol and sequence detection, soft and hard decision, Viterbi algorithm, Viterbi-equalizer; Soft input decoding of convolutional codes; Principles of Code Division Multiplex and Access (CDMA), near-far problem, multi-user interference, synchronous orthogonal receiver; Time varying multipath channels for mobile communication, time and Doppler-variant transfer function, statistical channel description, scattering function, AWGN channel with Rayleigh-fading, error probability; Principles of Turbo Coding.

### **ICT 6612: Advanced Optical Communication: 3 Credits**

Introduction to optical communication: Communication system, basic optical communication system, evolution of optical communication, advantages and disadvantages of optical communication; Optical fiber waveguides: construction, classification of fibers, modes of light propagation, transmission characteristics; Optical sources: Light emitting diodes (LED), semiconductor laser diodes, optical detectors: p-n photodiode, p-i-n photodiode, and avalanche photodiodes (APDs); Fiber connection: Fiber joints and fiber couplers, wavelength MUX and DeMUX, optical add-drop MUX; Optical amplifiers: optoelectronic amplifiers, fiber amplifiers, Raman and Brillouin amplifiers; Optical

modulation and detection schemes, direct and coherent detection receivers: Configuration, operation, noise sources, sensitivity and loss calculation, and performance curves; Digital and analog receivers; Fiber nonlinearities: Kerr effects—SPM, XPM, and FWM; Scattering effects—SRS and SBS; Transmission link analysis: point-to-point and point-to-multi point links, system configuration, link power budget, line-coding schemes. Optical multiplexing schemes: WDM, OFDM, OTDM and OCDMA; Optical networks.

### **ICT 6613: Mobile and Wireless Communications: 3 Credits**

Introduction and History of Wireless Systems, Cellular Systems, Wireless LANs, Satellite Systems, Paging Systems; Radio Propagation: free space propagation, propagation mechanisms, link budget design using path loss model, outdoor propagation models, indoor propagation models; Introduction to small-scale fading, impulse response model of multipath fading, parameters of multipath channel, type of small scale fading, Rayleigh and Ricean Distribution; Media Access Control: FDMA, TDMA, and CDMA, Aloha, CSMA, MACA; GSM overview: Standards, services and structure, GSM air interface physical layer: physical channels, logical channels, frame structures, modulation, coding and interleaving, GSM signaling: Data link layer, radio resource management, mobility management, Handover, location update and roaming in GSM; Short message service (SMS), circuit switched data, General Packet Radio Service (GPRS), Enhanced GPRS (EGPRS); CDMA Digital Cellular System (IS-95): Forward CDMA Channel, Reverse CDMA Channel; Satellite mobile communications: History, Localization, Handover, Routing; Broadcast System: Unidirectional distribution systems, DAB-architecture, DVB-container; WCDMA in 3rd generation system, Difference between WCDMA and 2G air interface, 3rd generation standards.

### **ICT 6615: Teletraffic Engineering: 3 Credits**

Introduction, traffic sources, resources, operational modes and traffic, unit of traffic, interarrival time and call holding time, traffic variation and busy hours; Random variables: Random variables, probability distribution function, probability density function, moments, Bernoulli random variable, uniform discrete random variable, Binomial distribution, Poisson distribution, negative exponential distribution, quality of service circuit switching voice networks, packet switched networks, probabilities of traffic systems; Models for circuit switched networks: Kendall notation, Erlang's loss formula ( $M/M/n/n$ ) and examples, marginal utility, Wilkinson's model, equivalent random method and examples, overflow routing in circuit switched networks; Models for packet switched networks:  $M/M/1$ ,  $M/G/1$ ,  $M/G/1$  priority queues, Erlang's delay formula ( $M/M/n$ ), System simulation: random number and random variable generation, event-by-event simulation method, sampling theory, simulation program organization, use of GSPN and other simulation tools.

### **ICT 6616: Radio Frequency Technology: 3 Credits**

Antennas: Launching of waves, transmission, definition of antennas, reciprocity, wave propagation, principal of equivalent sources: electric and magnetic surface current, uniqueness principle, Huygens principle, Hertzian vector, image theory; Aperture antennas:

Rectangular apertures, horn antenna, corrugated horn, circular aperture, reflector and lens antennas; Linear antennas: Field calculation, current distribution, linear dipoles and monopoles, design and feeding of dipole antennas, electrically short antennas, elementary dipole, receiving antennas - group antennas: Directivity, group factor, phased arrays, parasitic antennas; Electronic noise: Characteristics of noise voltages and currents, calculations with noise: Fourier analysis, correlation, superposition of noise quantities, transmission through linear networks, noise of 2-port networks: noise factor and temperature, noise matching, concatenation of noisy 2-port-networks; RF amplification: 2-terminal amplifiers, 2-port amplifiers: design with scattering parameters, selection of the point of operation, stability, unilateral design, wide-band amplifiers.

### **ICT 6621: Advanced Networking: 3 Credits**

The TCP/IP protocol stack: IP, ARP, TCP and UDP, DNS, ICMP, Internet addressing, routing, IP multicast, RSVP, Next Generation IP/IPv6 Interior gateway protocols: RIPv2, IGRP, EIGRP, OSPF; Wireless: Radio basics, satellite systems, WAP, current trends, issues with wireless over TCP; Congestion control: control, avoidance, control and avoidance Algorithms, congestion in the Internet; Network Security: IP security, firewalls; Management: Quality of service (QoS), network vs. distributed systems management, integrated service, differentiated service, protocols, web-based management.

### **ICT 6632: Advanced VLSI Design: 3 Credits**

Overview of VLSI technology; Review of CMOS logic circuits; Scaling And Interconnect Issues; Deep submicron design issues; Advanced clocking strategies; Clock distribution trees; High speed switching circuits; Low power design; Memory circuit design trends, Performance optimization; SOI technology and circuits; VLSI circuit in signal processing, VLSI circuit in wireless communication; Introduction to ASIC design.

### **ICT 6633: Advanced VLSI Testing: 3 Credits**

Overview of VLSI circuit; Faults in VLSI circuit; Fault modeling; Fault simulation: Serial, parallel and deductive fault simulation; Testing stuck faults and bridging faults; Test algorithms; Automatic test equipment, Functional testing; Design For Testability: controllability and observability, scan techniques, Built in self Test; Compression techniques; Testing of digital core; Memory Testing; Testing of analog and mixed signal core; Iddq Testing, Production Testing; Test effectiveness: coverage, yield and defect levels; System level test and diagnosis; MCM and core based testing.

### **ICT 6641: Advanced Embedded System Design: 3 Credits**

Hardware design for embedded systems; Software development for embedded systems; Network based embedded systems; Sensors and Transducers for embedded systems; Case study on advanced embedded system; Co-design using FPGAs; Multiprocessor systems; Case study on multiprocessor systems; Introduction to digital control; Its use within embedded systems; Case study on digital control in embedded systems; Design examples: a telephone PBX, Personal Digital Assistant (PDA).

**ICT: 6642 Real Time Computing for Embedded System**

Definition of real-time, temporal and event determinism, design principles and practice; Architecture review and interfacing, interrupts, traps and events, response times and latency, real-time clocks; Operating systems: Structure of an RTOS, nucleus, servers, schedulers and dispatchers; Synchronization and communication: priority and distribution queues, system Modeling, static scheduling, priority drive scheduling; Real-time communication, device drivers, operating systems; Languages in realtime, concurrency issues, Real-time programming.

**ICT: 6651 Advanced Digital Signal Processing**

Overview of digital signal processing: Bandpass signals lowpass equivalent signals, Bandpass sampling, concept of digital frequency, DFT-based filtering, windows, frequency measurement; Spectral estimation: Introduction and periodogram, classical methods, minimum variance method, parametric methods; Multirate signal processing: Applications motivation, decimation and interpolation, sample rate conversion for rational D/I, approximate sample rate conversion for irrational D/I, polyphase implementation of sampling rate conversion, DFT filter banks, general filter banks - alias cancellation and perfect reconstruction; Adaptive signal processing: Applications motivation, Wiener filtering, the Widrow LMS algorithm, performance analysis of LMS algorithm, introduction to the RLS algorithm; Probability and random processes: Overview of probability, probability density function, mean, variance, correlation/covariance, Gaussian random variables, overview of random processes, classification, multiple random processes, examples.

**ICT 6900: Selected Topics in ICT: 3 Credits**

A topic of current interest on information & communication technology. Syllabus should be approved by RAC prior to the commencement of the term. In each term only one such course title under this course number can be offered. However a student can register only once for this course regardless of the topic offered under this course number and title.



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